REMARKS

Favorable reconsideration of this application is requested in view of the above amendments and the following remarks.

Claims 1, 2, and 24-26 are canceled herein without prejudice or disclaimer. Applicants note that the limitations formerly in claims 1, 2, and 26 are incorporated into several dependent claims to render them independent. Applicants also note that claims 24 and 25 are canceled herein as being duplicates of claims 7 and 8.

Claims 3, 4, 7, 27-29, 36, 37, and 39 are amended into independent form herein by incorporating the limitations of their former parent claims. Claims 3, 4, 7, 27-29, 36, 37, and 39 are further amended herein to recite that the transformer is adapted to be operated only at a frequency that is less than the resonant frequency of the transformer. This is supported by the disclosure, for example at page 15, lines 22-23.

No new matter has been added. Claims 3-8, 27-29, and 36-46 are pending in the application.

Applicants submit herewith an Information Disclosure Statement. An English-language translation of Japanese Patent Application Laid-Open Publication No. 54-110424 is cited thereon. Applicants note that this translation is not certified as accurate, however, Applicants have no reason to believe it is inaccurate. It is submitted for the Examiner's convenience. In addition, an article entitled Coreless Planar Printed-Circuit-Board (PCB) Transformers -- A Fundamental Concept for Signal and Energy Transfer is also cited on the Information Disclosure Statement. This document, published by the inventors subsequent to the filing of the pending application, may prove illustrative, and is also provided for the Examiner's convenience.

Claims 1, 2 and 26 are rejected under 35 U.S.C. § 102(b) as being anticipated by prior art JP 54-110424. Applicants respectfully traverse the rejection.

Claims 1, 2, and 26 are canceled herein without prejudice, rendering the rejection moot. Applicant does not concede the correctness of the rejection.

Claims 1-3, 26-27 and 36-46 are rejected under 35 U.S.C. § 103(b) as being obvious from JP 54-110424 in view of Tolfsen et al. (U.S. Patent No. 5,579,202). Applicants respectfully traverse the rejection.

Claims 1, 2, and 26 are canceled herein, rendering that portion of the rejection moot. Applicant does not concede the correctness of the rejection as applied to these claims.

The rejection characterizes JP 54-110424 as disclosing a general structure similar to that of the claimed invention. Applicants do not concede the correctness of the characterization.

The rejection also relies upon Tolfsen to disclose a frequency range of 500 kHz to 4 MHz. The rejection further asserts that based upon this range it would be obvious to combine a transformer operating design of Tolfsen with a structure of Japan 54-110424, and that this combination would be equivalent to the claimed invention.

Applicants respectfully disagree.

Each of independent claims 3, 27, and 36 recites that the transformer is adapted to be operated only at a frequency that is less than the resonant frequency of the transformer.

Such an arrangement is advantageous as described in the specification, for example at page 15, line 15 through page 16, line 2. In summary, in the claimed invention, a voltage gain can be realized by operating the transformer at a frequency that is less than the resonant frequency.

Applicants find no such disclosure or suggestion in JP 54-110424. Indeed, Applicants find no disclosure or suggestion of anything regarding operating frequency, whether related to voltage gain or not.

Furthermore, Applicants respectfully submit that Tolfsen actually teaches away from the claimed invention. Applicants reference for example column 4, lines 46-47, which in explaining the function of the device of Tolfsen recite in part that "the transformer operates above its own resonance frequency" [emphasis added]. This is directly contrary to the principles of the claimed invention.

Applicants find no disclosure or suggestion in Tolfsen that the operating frequency should or even could be below the resonance frequency, much less that the operating frequency must be below the resonance frequency.

Furthermore, Applicants respectfully submit that Tolfsen is directed to a completely different device from the claimed invention, operating on different principles to a different end, and respectfully question whether a person of ordinary skill in the art would consider Tolfsen when attempting to provide the features of the claimed invention.

For example, Applicants note that the claimed invention is implicitly an AC device, as evidenced by repeated references throughout to various frequencies ranging from kHz to MHz. In contrast, Tolfsen describes a device for use with pulsing DC voltage, as disclosed for example in the abstract.

In addition to this basic functional difference, and at least in part because of it, Applicants note that a device of Tolfsen is structurally different from one according to the claimed invention.

For example, the rejection characterizes capacitors C1, C2, and C3 of Tolfsen as being used to control the frequency of the transformer. Applicants respectfully disagree with this

characterization, and reference for example column 4, line 16 through column 5, line 15. As described therein, and as illustrated and labeled in Figure 8, these three capacitors are used to form three oscillatory circuits. More particularly, as disclosed at column 5, lines 8-15, oscillatory circuits 1 and 2 are used to produce the DC voltages. Likewise, as described at column 4, lines 16-28, capacitor C3 has a negative temperature coefficient, and is used to counterbalance the positive temperature coefficient of the transformer, so as to render the device temperature stable. Applicant finds no disclosure that any of the capacitors control a frequency of the transformer.

As the claimed invention according to claims 3, 27, and 36 comprises features neither disclosed nor suggested by either JP 54-110424 or Tolfsen, alone or in combination, Applicants respectfully submit that claims 3, 27, and 36 are not obvious from JP 54-110424 in view of Tolfsen. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 37-46 depend from claim 36, and include the limitations thereof. The above arguments made with regard to claim 36 apply equally to them, and Applicants respectfully submit that separate arguments need not be presented on behalf of these dependent claims at this time. Applicants do not concede the correctness of the rejection, and reserve the right to present further arguments against it.

Claims 4-6 and 28-29 are rejected under 35 U.S.C. § 103(b) as being obvious from JP 54-110424 in view of Tolfsen, further in view of Commander et al. (U.S. Patent No. 4,748,532). Applicants respectfully traverse the rejection.

As in the preceding rejection, each of independent claims 4, 28, and 29 recites that the transformer is adapted to be operated only at a frequency that is less than the resonant frequency of the transformer.

Commander is characterized as disclosing a transformer operated by a high frequency carrier signal modulated by a low-frequency switching signal. However, even if Commander is

correctly characterized, which point Applicants do not concede, Commander does not remedy the deficiencies of JP 54-110424 and Tolfsen as argued above.

In particular, Applicants find no disclosure or suggestion in Commander regarding the operation of a coreless PCB transformer only at frequencies lower than the resonance frequency of the transformer.

In addition, Applicants respectfully question whether a person of ordinary skill in the art would consider Commander when attempting to provide the features of the claimed invention.

Even if Commander is interpreted as disclosing a particular frequency range similar to that of the claimed invention, or a method of frequency modulation similar to that of the claimed invention, which points Applicants do not concede, Applicants note that Commander is directed to a core-based transformer.

However, the rejected claims recite a coreless transformer. The choice of operating frequencies in coreless PCB transformers is not identical to core-based transformers. Core-based transformers have core losses, core saturation, and upper frequency limitation problems. Coreless PCB transformers do not have these disadvantages. Therefore, work regarding the determination of appropriate frequencies and/or modulations for core-based transformers, i.e. optimizing the carrier signal and switching signal, does not lead in an obvious fashion to appropriate frequencies and/or modulation for coreless PCB transformers.

As the claimed invention according to claims 4, 28, and 29 comprises features neither disclosed nor suggested by any of JP 54-110424, Tolfsen, or Commander, alone or in combination, Applicants respectfully submit that claims 2, 28, and 29 are not obvious from JP 54-110424 in view of Tolfsen, further in view of Commander. Reconsideration and withdrawal of the rejection is respectfully requested.

Claims 5-6 depend from claim 4, and include the limitations thereof. The above arguments made with regard to claim 4 apply equally to them, and Applicants respectfully submit that separate arguments need not be presented on behalf of these dependent claims at this time. Applicants do not concede the correctness of the rejection, and reserve the right to present further arguments against it.

Claims 7-8 and 25-26 are rejected under 35 U.S.C. § 103(b) as being obvious from JP 54-110424 in view of Tolfsen, further in view of Commander, further in view of Miyoshi et al. (U.S. Patent No. 3,866,086). Applicants respectfully traverse the rejection.

Claims 25 and 26 are canceled herein, rendering that portion of the rejection moot. Applicants do not concede the correctness of the rejection as applied to these claims.

Again, independent claim 7 recites that the transformer is adapted to be operated only at a frequency that is less than the resonant frequency of the transformer.

Miyoshi is characterized as disclosing a capacitance connected across a secondary winding for adjusting resonance frequency. However, even if Miyoshi is correctly characterized, which point Applicants do not concede, Miyoshi does not remedy the deficiencies of JP 54-110424, Tolfsen, and Commander as argued above.

In brief, Miyoshi also does not disclose or suggest a coreless PCB transformer adapted to be operated only at a frequency less than the resonant frequency of the transormer.

As the claimed invention according to claims 4, 28, and 29 comprises features neither disclosed nor suggested by any of JP 54-110424, Tolfsen, Commander, or Miyoshi, alone or in combination, Applicants respectfully submit that claims 2, 28, and 29 are not obvious from JP 54-110424 in view of Tolfsen, further in view of Commander and Miyoshi. Reconsideration and withdrawal of the rejection is respectfully requested.

Claim 8 depend from claim 1, and includes the limitations thereof. The above arguments made with regard to claim 1 apply equally to it, and Applicants respectfully submit that separate arguments need not be presented on behalf of claim 8 at this time. Applicants do not concede the correctness of the rejection, and reserve the right to present further arguments against it.

In addition, with regard to claim 8, although the rejection characterizes the capacitor 29 of Miyoshi as being in parallel with the secondary winding, Applicants note that Miyoshi actually discloses that the capacitor is, at least for functional purpose, connected in series with the secondary winding, not in parallel. Applicant references, for example, column 5, lines 61-63, which read in part that "it is equivalent as if the capacitor 29 were connected in series with the first secondary winding 25".

As all matters raised in the Office Action have now been addressed, Applicants believe that all pending claims are in condition for immediate allowance. Applicants respectfully request favorable reconsideration of the pending claims in the form of a Notice of Allowance.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicant's primary attorney-of record, Michael D. Schumann (Reg. No. 30,422), at (612) 336-4638.

Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	HUI ET AL.	Examiner:	T. NGUYEN
Serial No.:	09/316,735	Group Art Unit:	2832
Filed:	MAY 21, 1999	Docket No.:	12364.1USI1
Title:	CORELESS PRINTED-CIRCUIT-BOARD (PCB) TRANSFORMERS AND OPERATING TECHNIQUES THEREFOR		

AMENDED CLAIMS MARKED TO SHOW CHANGES

3. (amended) A coreless printed circuit board transformer [as claimed in claim 1] comprising first and second windings deposited on a printed circuit board, said second winding being deposited on a side of said circuit board that is opposed to a side of said circuit board whereon said first winding is deposited, wherein said transformer is adapted to be operated only at a frequency [of] that is less than a resonant frequency of said transformer, said frequency being between 300 kHz and 20 MHz.

4. (amended) A coreless printed circuit board transformer [as claimed in claim 1] comprising first and second windings deposited on a printed circuit board, said second winding being deposited on a side of said circuit board that is opposed to a side of said circuit board whereon said first winding is deposited, wherein said transformer is adapted to be operated by a high-frequency carrier signal modulated by a low-frequency switching signal, and wherein said transformer is adapted to be operated only at a frequency that is less than a resonant frequency of said transformer.

7. (amended) A coreless printed circuit board transformer [as claimed in claim 1] comprising first and second windings deposited on a printed circuit board, said second winding being deposited on a side of said circuit board that is opposed to a side of said circuit board whereon said first winding is deposited, further comprising means for adjusting a resonant frequency of the transformer, wherein said transformer is adapted to be operated only at a frequency that is less than said resonant frequency of said transformer.

27. (amended) A coreless printed circuit board transformer [as claimed in claim 26] comprising first and second windings deposited on a printed circuit board, said second winding being deposited on a side of said circuit board that is opposed to a side of said circuit board whereon said first winding is deposited, wherein said transformer is adapted to be operated at an optimum frequency, said optimum frequency being a frequency near a frequency at which an impedance of a transformer equivalent circuit is at a maximum, and wherein said transformer is adapted to be operated only at a frequency [of] that is less than a resonant frequency of said transformer, said frequency being from 100 kHz to at least 20 MHz.

28. (amended) A coreless printed circuit board transformer [as claimed in claim 26] comprising first and second windings deposited on a printed circuit board, said second winding being deposited on a side of said circuit board that is opposed to a side of said circuit board whereon said first winding is deposited, wherein said transformer is adapted to be operated at an optimum frequency, said optimum frequency being a frequency near a frequency at which an impedance of a transformer equivalent circuit is at a maximum, and wherein said transformer is adapted to be operated by a high-frequency carrier signal modulated by a low-frequency switching signal, said carrier signal being at a frequency corresponding to a maximum impedance of the transformer, and wherein said transformer is adapted to be operated only at a frequency that is less than a resonant frequency of said transformer.

29. (amended) A coreless printed circuit board transformer [as claimed in claim 2] comprising first and second windings deposited on a printed circuit board, said second winding being deposited on a side of said circuit board that is opposed to a side of said circuit board whereon said first winding is deposited, wherein said transformer is adapted to be operated at an optimum frequency, said optimum frequency being a frequency at which an impedance of a transformer equivalent circuit of said transformer is a maximum, and wherein said transformer is adapted to be operated only at a frequency [of] that is less than a resonant frequency of said transformer, said frequency being from 100 kHz to at least 20 MHz.

36. (amended) A coreless printed circuit board transformer [as claimed in claim 1] comprising first and second windings deposited on a printed circuit board, said second winding being deposited on a side of said circuit board that is opposed to a side of said circuit board whereon said first winding is deposited, wherein said transformer is adapted to be operated at an optimum frequency, said optimum frequency being a frequency at which an impedance of said transformer is a maximum, and wherein said transformer is adapted to be operated only at a frequency that is less than a resonant frequency of said transformer.

37. (amended) A coreless printed circuit board transformer [as claimed in claim 2] comprising first and second windings deposited on a printed circuit board, said second winding being deposited on a side of said circuit board that is opposed to a side of said circuit board whereon said first winding is deposited, wherein said transformer is adapted to be operated at an optimum frequency, said optimum frequency being a frequency at which an impedance of a transformer equivalent circuit of said transformer is a maximum, wherein said optimum frequency is between 300 kHz and 20 MHz, and wherein said transformer is adapted to be operated only at a frequency that is less than a resonant frequency of said transformer.

39. (amended) A coreless printed circuit board transformer [as claimed in claim 2] comprising first and second windings deposited on a printed circuit board, said second winding being deposited on a side of said circuit board that is opposed to a side of said circuit board whereon said first winding is deposited, wherein said transformer is adapted to be operated at an optimum frequency, said optimum frequency being a frequency at which an impedance of a transformer equivalent circuit of said transformer is a maximum, further comprising means for adjusting said optimum frequency, and wherein said transformer is adapted to be operated only at a frequency that is less than a resonant frequency of said transformer.